

SIPMOS® Power-Transistor

Feature

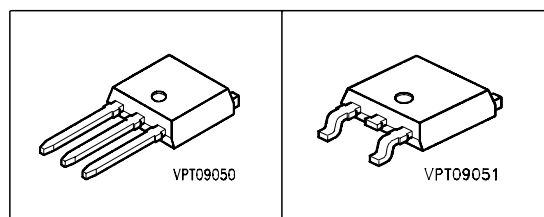
- P-Channel
- Enhancement mode
- Logic Level
- 175°C operating temperature
- Avalanche rated
- dv/dt rated

Product Summary

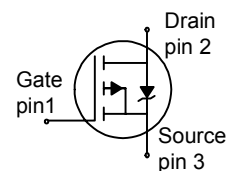
V_{DS}	-60	V
$R_{DS(on)}$	0.25	Ω
I_D	-9.7	A

P-TO251-3-1

P-TO252



Type	Package	Ordering Code
SPD09P06PL	P-TO252	Q67042-S4007
SPU09P06PL	P-TO251-3-1	Q67042-S4020



Maximum Ratings, at $T_j = 25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Value	Unit
Continuous drain current	I_D		A
$T_C=25^\circ\text{C}$		-9.7	
$T_C=100^\circ\text{C}$		-6.8	
Pulsed drain current	$I_{D \text{ puls}}$	-38.8	
$T_C=25^\circ\text{C}$			
Avalanche energy, single pulse	E_{AS}	70	mJ
$I_D=-9.7 \text{ A}$, $V_{DD}=-25\text{V}$, $R_{GS}=25\Omega$			
Avalanche energy, periodic limited by T_{jmax}	E_{AR}	4.2	
Reverse diode dv/dt	dv/dt	6	kV/ μs
$I_S=-9.7\text{A}$, $V_{DS}=-48$, $di/dt=200\text{A}/\mu\text{s}$, $T_{jmax}=175^\circ\text{C}$			
Gate source voltage	V_{GS}	± 20	V
Power dissipation	P_{tot}	42	W
$T_C=25^\circ\text{C}$			
Operating and storage temperature	T_j, T_{stg}	-55... +175	$^\circ\text{C}$
IEC climatic category; DIN IEC 68-1		55/175/56	

Thermal Characteristics

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Characteristics					
Thermal resistance, junction - case	R_{thJC}	-	-	3.6	K/W
Thermal resistance, junction - ambient, leaded	R_{thJA}	-	-	100	
SMD version, device on PCB:	R_{thJA}				
@ min. footprint		-	-	75	
@ 6 cm ² cooling area ¹⁾		-	-	50	

Electrical Characteristics, at $T_j = 25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static Characteristics					
Drain-source breakdown voltage $V_{GS}=0V, I_D=-250\mu A$	$V_{(BR)DSS}$	-60	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D=-250\mu A$	$V_{GS(th)}$	-1	-1.5	-2	
Zero gate voltage drain current $V_{DS}=-60V, V_{GS}=0V, T_j=25^{\circ}C$ $V_{DS}=-60V, V_{GS}=0V, T_j=150^{\circ}C$	I_{DSS}	- -	-0.1 -10	-1 -100	μA
Gate-source leakage current $V_{GS}=-20V, V_{DS}=0V$	I_{GSS}	-	-10	-100	
Drain-source on-state resistance $V_{GS}=-4.5V, I_D=-5.4A$	$R_{DS(on)}$	-	0.3	0.4	Ω
Drain-source on-state resistance $V_{GS}=-10V, I_D=-6.8A$	$R_{DS(on)}$	-	0.2	0.25	

¹⁾ Device on 40mm*40mm*1.5mm epoxy PCB FR4 with 6cm² (one layer, 70 μm thick) copper area for drain connection. PCB is vertical without blown air.

Electrical Characteristics, at $T_j = 25\text{ }^{\circ}\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Dynamic Characteristics						
Transconductance	g_{fs}	$V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$, $I_D = -5.4$	1.8	3.5	-	S
Input capacitance	C_{iss}	$V_{GS} = 0V$, $V_{DS} = -25V$, $f = 1MHz$	-	360	450	pF
Output capacitance	C_{oss}		-	103	130	
Reverse transfer capacitance	C_{rss}		-	40	50	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = -30V$, $V_{GS} = -4.5V$, $I_D = -5.4$, $R_G = 6\Omega$	-	11	17	ns
Rise time	t_r	$V_{DD} = -30V$, $V_{GS} = -4.5V$,	-	168	252	
Turn-off delay time	$t_{d(off)}$	$I_D = -5.4A$, $R_G = 6\Omega$	-	49	74	
Fall time	t_f		-	89	134	

Gate Charge Characteristics

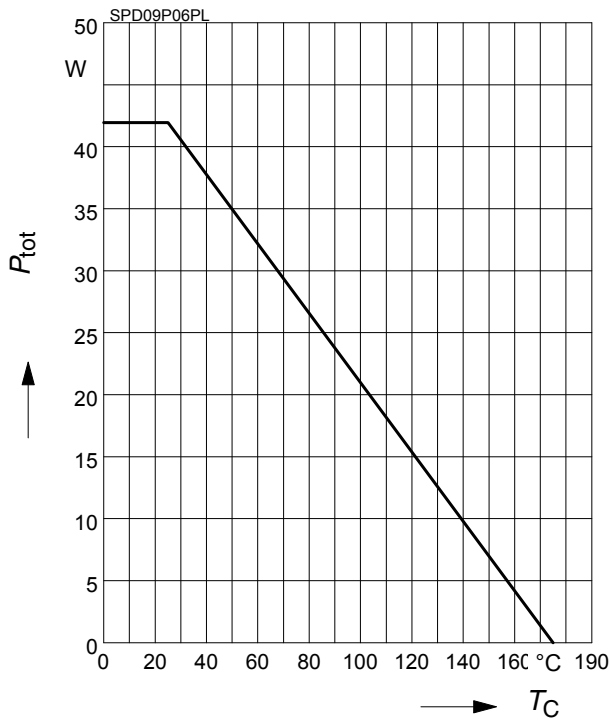
Gate to source charge	Q_{gs}	$V_{DD} = -48V$, $I_D = -9.7A$	-	1.3	2	nC
Gate to drain charge	Q_{gd}		-	5.1	7.5	
Gate charge total	Q_g	$V_{DD} = -48V$, $I_D = -9.7A$, $V_{GS} = 0$ to $-10V$	-	14	21	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} = -48V$, $I_D = -9.7A$	-	-4.1	-	V

Reverse Diode

Inverse diode continuous forward current	I_S	$T_C = 25^{\circ}\text{C}$	-	-	-9.7	A
Inverse diode direct current, pulsed	I_{SM}		-	-	-38.8	
Inverse diode forward voltage	V_{SD}	$V_{GS} = 0V$, $I_F = -9.7A$	-	-1.1	-1.4	V
Reverse recovery time	t_{rr}	$V_R = -30V$, $I_F = I_S$	-	52	76	ns
Reverse recovery charge	Q_{rr}	$di_F/dt = 100A/\mu s$	-	64	96	

1 Power dissipation

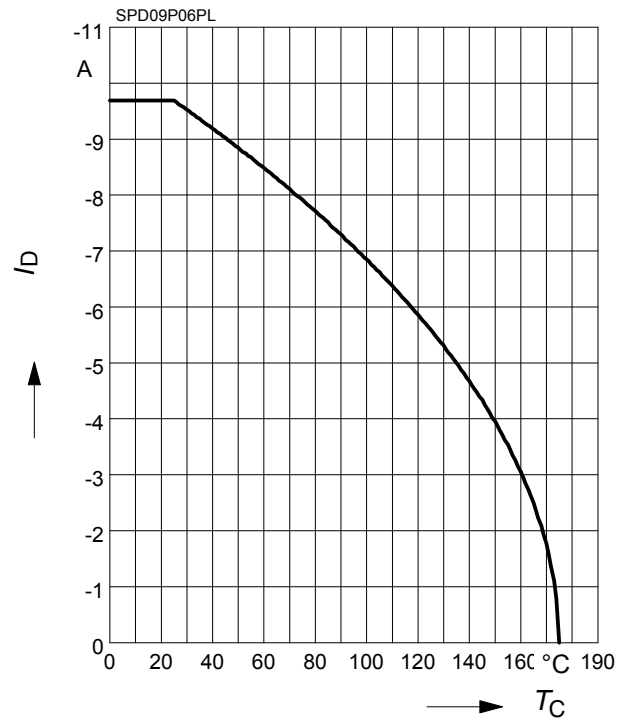
$$P_{\text{tot}} = f(T_C)$$



2 Drain current

$$I_D = f(T_C)$$

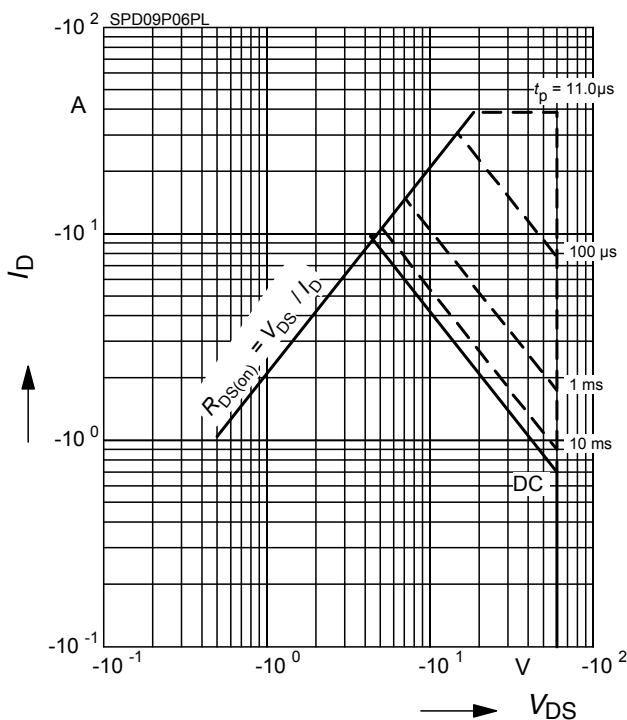
parameter: $V_{GS} \geq 10 \text{ V}$



3 Safe operating area

$$I_D = f(V_{DS})$$

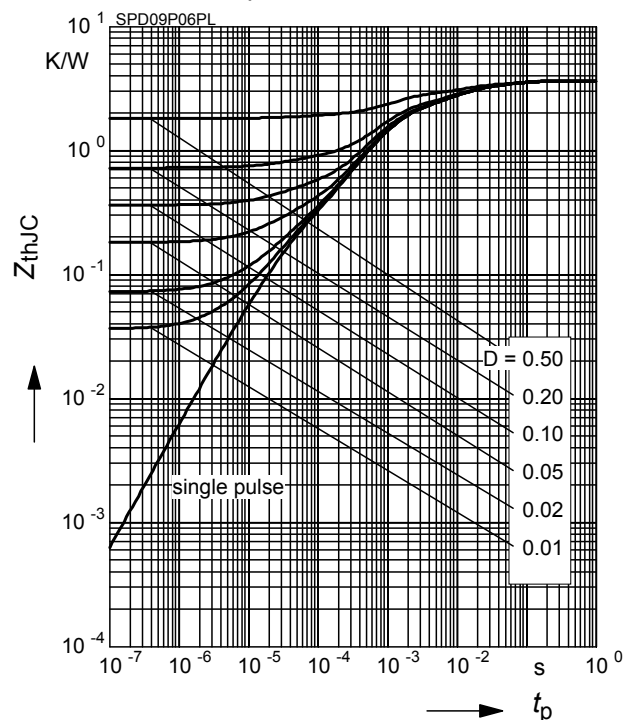
parameter: $D = 0$, $T_C = 25 \text{ °C}$



4 Transient thermal impedance

$$Z_{thJC} = f(t_p)$$

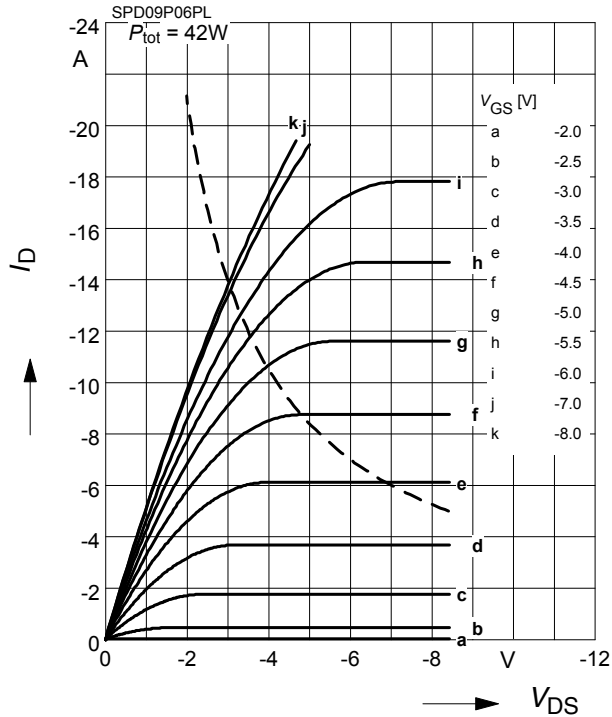
parameter: $D = t_p/T$



5 Typ. output characteristic

$$I_D = f(V_{DS}); T_j = 25^\circ\text{C}$$

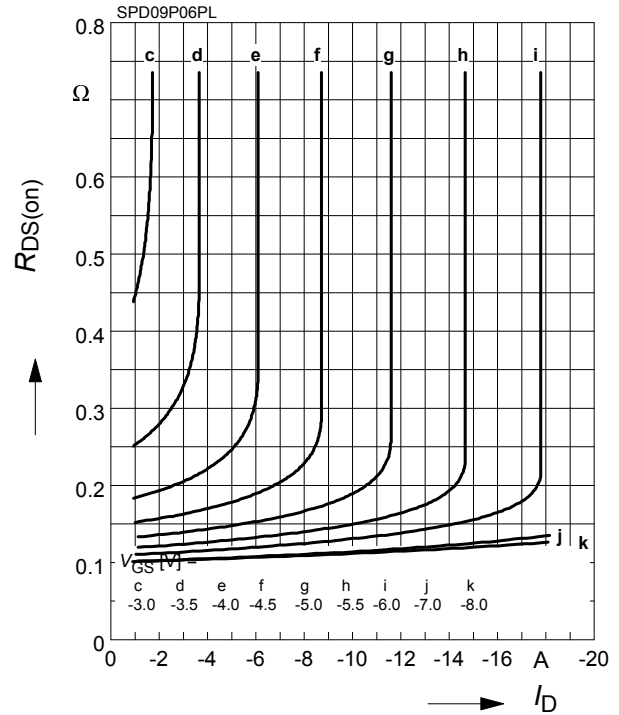
parameter: $t_p = 80 \mu\text{s}$



6 Typ. drain-source on resistance

$$R_{DS(\text{on})} = f(I_D)$$

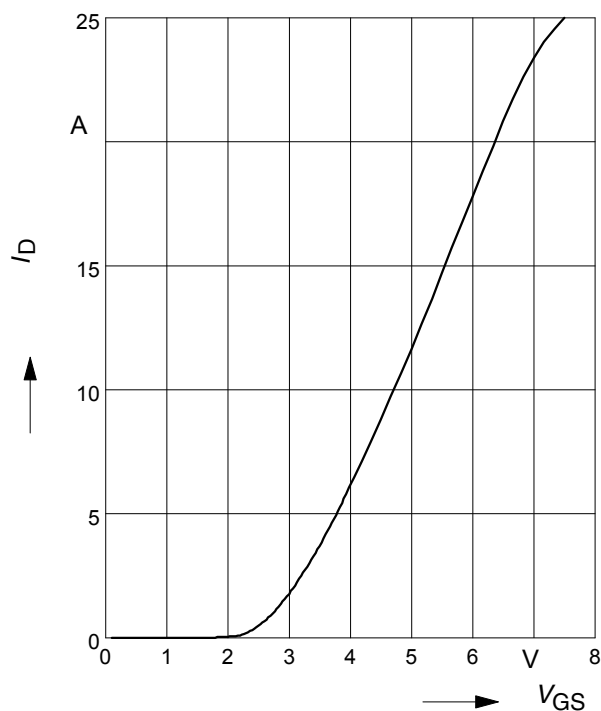
parameter: V_{GS}



7 Typ. transfer characteristics

$$I_D = f(V_{GS}); V_{DS} \geq 2 \times I_D \times R_{DS(\text{on})\text{max}}$$

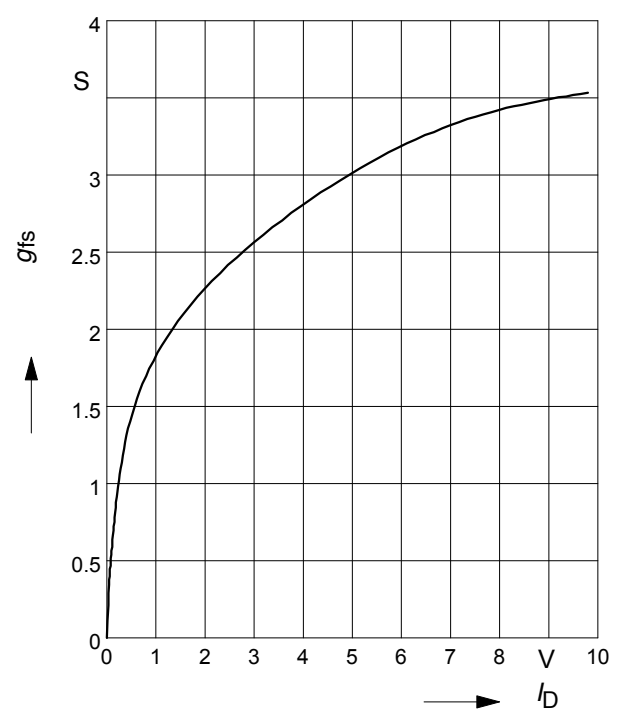
parameter: $t_p = 80 \mu\text{s}$



8 Typ. forward transconductance

$$g_{fs} = f(I_D); T_j = 25^\circ\text{C}$$

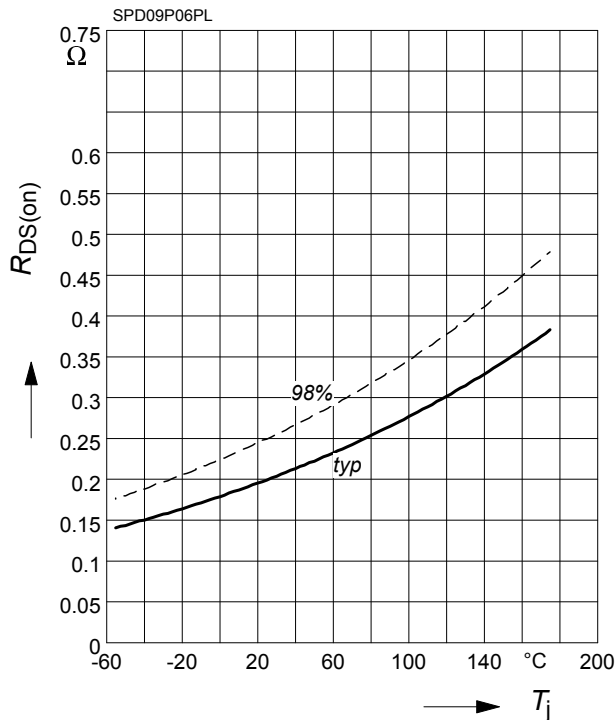
parameter: g_{fs}



9 Drain-source on-state resistance

$$R_{DS(on)} = f(T_j)$$

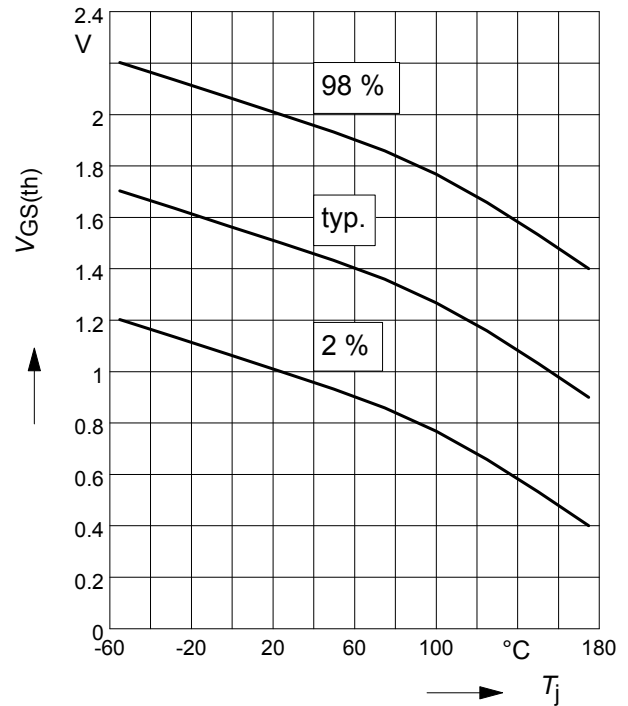
parameter: $I_D = -6.8 \text{ A}$, $V_{GS} = -10 \text{ V}$



10 Gate threshold voltage

$$V_{GS(th)} = f(T_j)$$

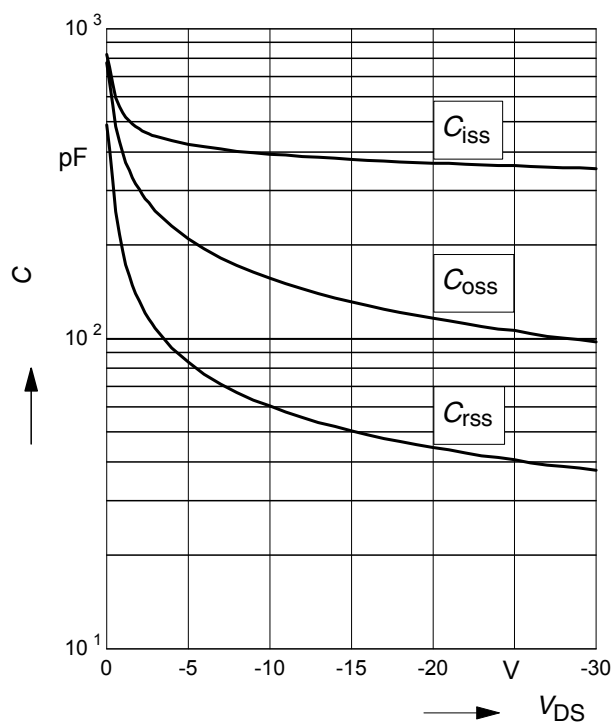
parameter: $V_{GS} = V_{DS}$, $I_D = -250 \mu\text{A}$



11 Typ. capacitances

$$C = f(V_{DS})$$

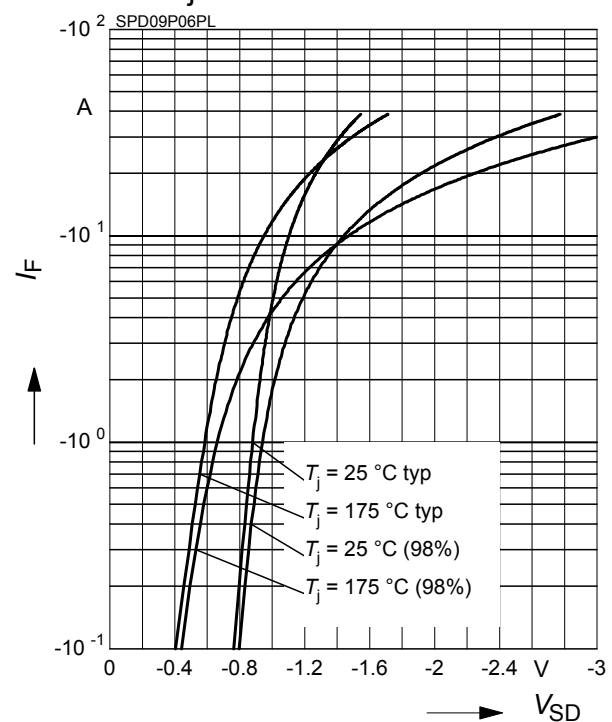
parameter: $V_{GS} = 0\text{V}$, $f = 1 \text{ MHz}$



12 Forward character. of reverse diode

$$I_F = f(V_{SD})$$

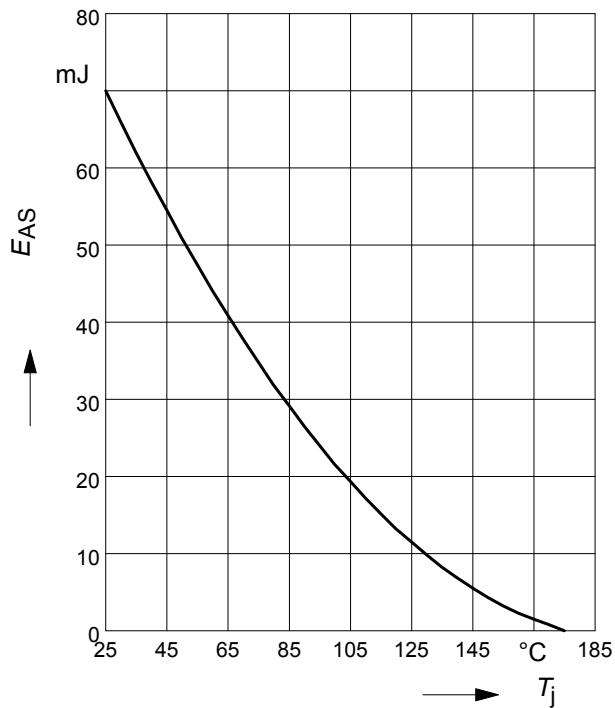
parameter: T_j , $t_p = 80 \mu\text{s}$



13 Typ. avalanche energy

$$E_{AS} = f(T_j)$$

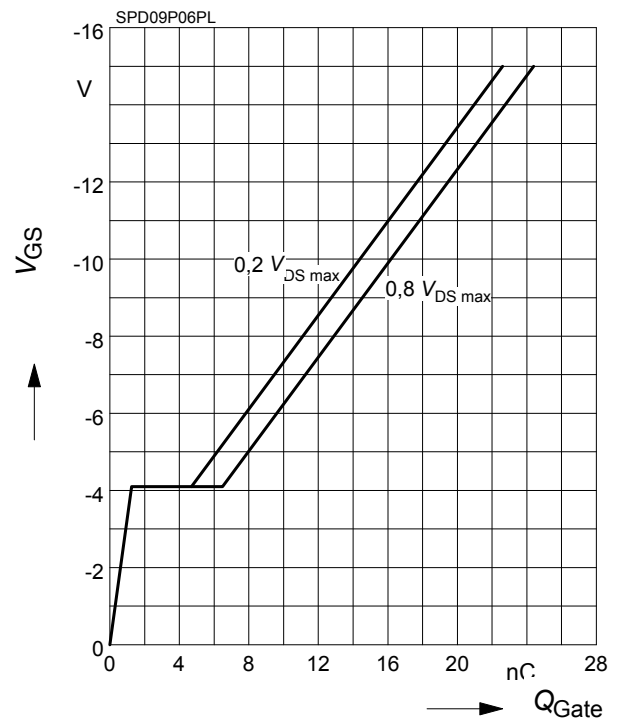
par.: $I_D = -9.7 \text{ A}$, $V_{DD} = -25 \text{ V}$, $R_{GS} = 25 \Omega$



14 Typ. gate charge

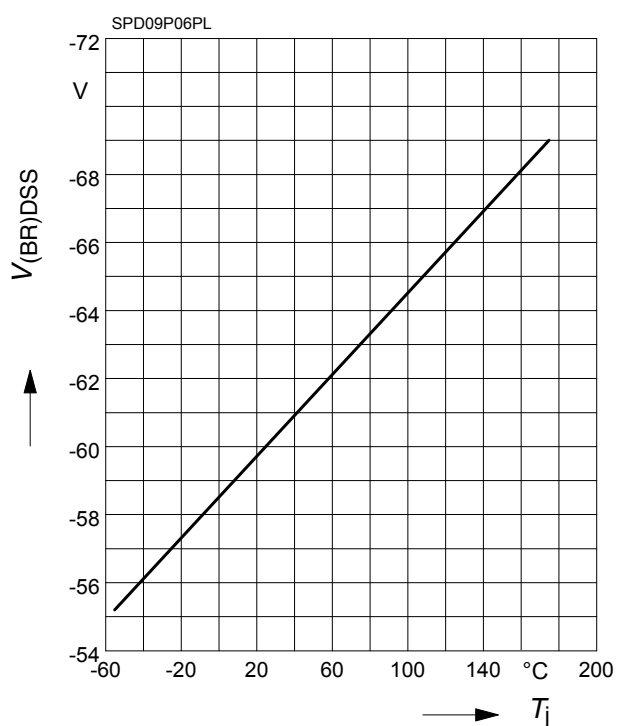
$$V_{GS} = f(Q_{Gate})$$

parameter: $I_D = -9.7 \text{ A}$ pulsed



15 Drain-source breakdown voltage

$$V_{(BR)DSS} = f(T_j)$$



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